

Space-Based Technologies – 4 - Health

A Geospatial Intelligence Perspective

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The Problem Set

- Space-based systems collect spatially-referenced data which must be analyzed, interpreted, and converted into context-relevant information which may be exploited for advantageous use to solve a problem (Geospatial Intelligence, or GEOINT).
- At least 3 fundamental processes beyond the technical domain of data collection and analysis must function:
 - Standards development processes which enable access and distribution.
 - Communication processes which both identify audiences and account for creator and user cognitive bias.
 - Integrative processes which facilitate wholistic approaches to discover larger scale problems.

Data Standards

- Data standards must cover:
 - Exchange/transmission
 - Completeness
 - Quality
 - Application area
 - Format/codification
- Data standards are best accomplished using a consensus driven process which results in a modular approach
- Standards should be registered, hosted by a recognized authority, and advertised
- Education materials required

Which Standard???

Interoperability for COVID-19 Novel Coronavirus Pandemic



Type	Standard / Implementation Specification	Standards Process Maturity	Implementation Maturity	Adoption Level	Federally required	Cost	Test Tool Availability
Standard	LOINC®	Final	Production	● ● ● ● ●	Yes	Free	N/A
Standard	SNOMED CT®	Final	Production	● ● ● ● ●	Yes	Free	N/A
Standard	ICD-10-CM	Final	Production	● ● ● ● ●	Yes	Free	N/A
Standard	Current Procedural Terminology (CPT)	Final	Production	● ● ● ● ●	Yes	\$	N/A
Standard	HCPCS	Final	Production	● ● ● ● ●	Yes	Free	N/A
<i>Emerging Implementation Specification</i>	<i>Logica COVID-19 (FHIR v4.0.1) Implementation Guide 0.4.0 CI Build</i>	<i>In Development</i>	<i>Feedback requested</i>	<i>Feedback Requested</i>	<i>No</i>	<i>Free</i>	<i>N/A</i>
<i>Emerging Implementation Specification</i>	<i>HL7 FHIR (v4.0.1) Situational Awareness for Novel Epidemic Response (SANER) IG 0.1.0 Continuous Build</i>	<i>In Development</i>	<i>Feedback requested</i>	<i>Feedback Requested</i>	<i>No</i>	<i>Free</i>	<i>N/A</i>

<https://www.healthit.gov/isa/covid-19>

DHIS2 has released a digital data package to accelerate case detection, situation reporting, active surveillance and response for COVID-19. The package is inspired by the Ministry of Health Sri Lanka's pioneering design of DHIS2 tracker for COVID-19 case detection and draws on years of collaboration with the World Health Organisation (WHO) to develop information system standards for case-based disease surveillance. The COVID-19 digital data package includes standard metadata aligned with the WHO's [technical guidance on COVID-19 surveillance and case definitions](#) and implementation guidance to enable rapid deployment in countries.

DHIS2 is currently being used for COVID-19 Surveillance in countries around the world. Explore the map below to see where the DHIS2 COVID-19 Packages are being tested and deployed.



IEEE Standards for Responding to Global COVID-19 Public Health Emergency

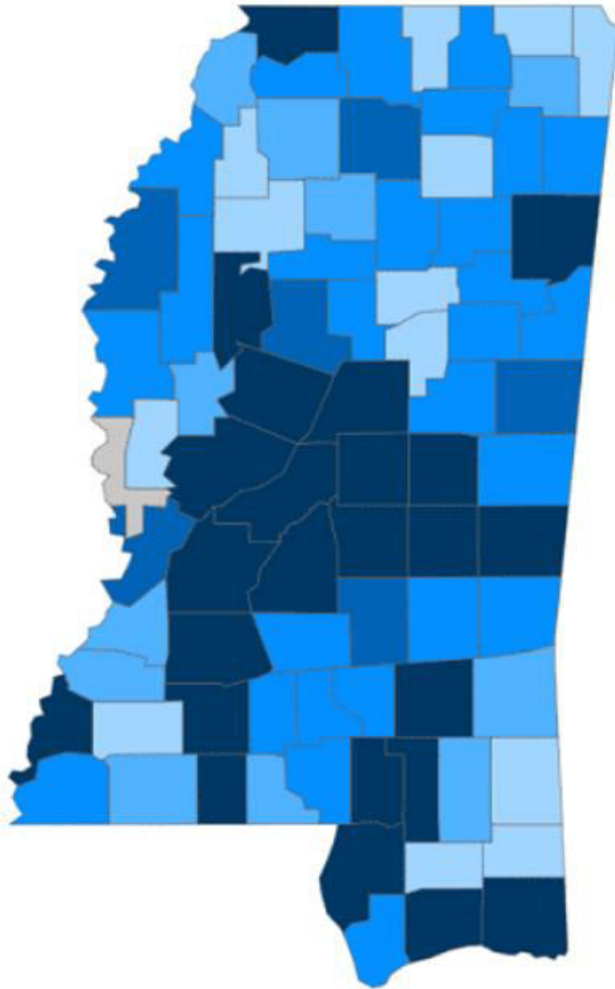
IEEE is providing no-cost public access to important IEEE standards, used by technologists, engineers, scientists, manufacturers, as they respond to the global COVID-19 public health emergency. Click "Access Standards" to access and download a PDF of the standards relevant to the global health pandemic.

[ACCESS STANDARDS](#)

Communication and Cognitive Bias

- A map is a visual communication device used to transmit spatially-referenced concepts from an originator to a receiver.
- Cognitive biases skew how data are both represented by the originator and understood by the receiver.
 - Confirmation bias, clustering illusion, contrast effects, framing effect...
- The purpose of a map and its desired use must be followed to ensure the intended message is transmitted.
 - Cartographic conventions and norms are important
 - One size does not fit all – cultural conventions differ globally

Mississippi COVID-19 Cases and Deaths by Race with Ethnicity as of 6 pm CT, May 12, 2020



● 1 to 25 ● 26 to 50 ● 51 to 100 ● 101 to 150 ● >150

Total Cases

10,090

	American Indian or Alaska Native					
	Asian	Black	White	Other	Unknown	
Non Hispanic	82	29	4931	2792	112	17
Hispanic	3	1	21	124	386	13
Unknown Ethnicity	208	6	485	382	121	377

Total Deaths

465

	American Indian or Alaska Native					
	Asian	Black	White	Other	Unknown	
Non Hispanic	10	0	249	190	0	0
Hispanic	0	0	1	2	3	0
Unknown Ethnicity	2	0	2	6	0	0

COVID-19 Confirmed Infection Rate

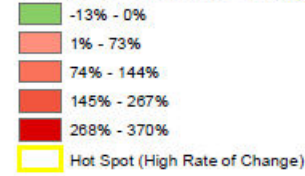
10 May 2020

Cases per Thousand (Total #)

1 Dot = 0.1

Rate w/o LTC1105

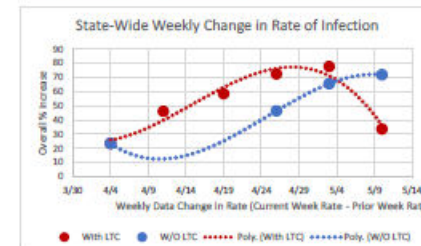
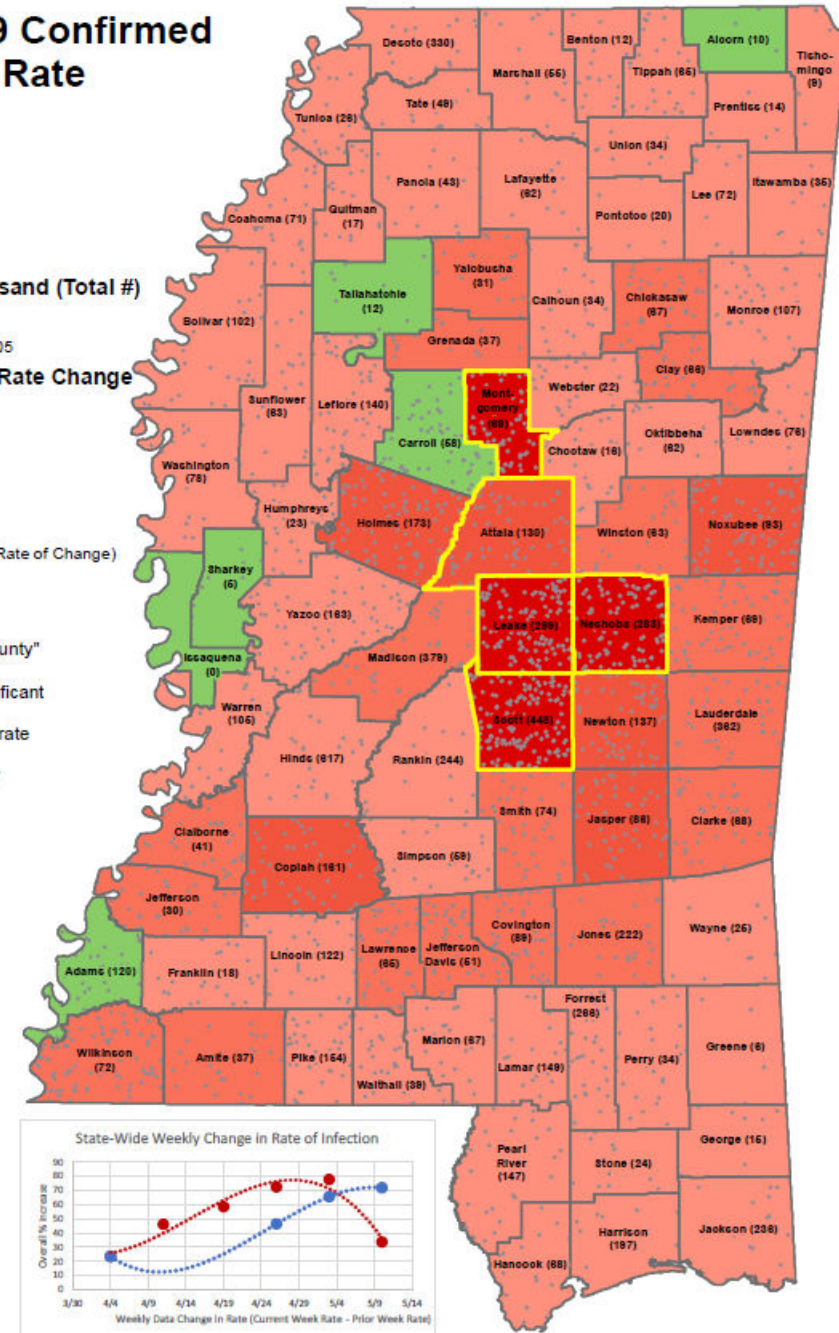
7-Day Infection Rate Change



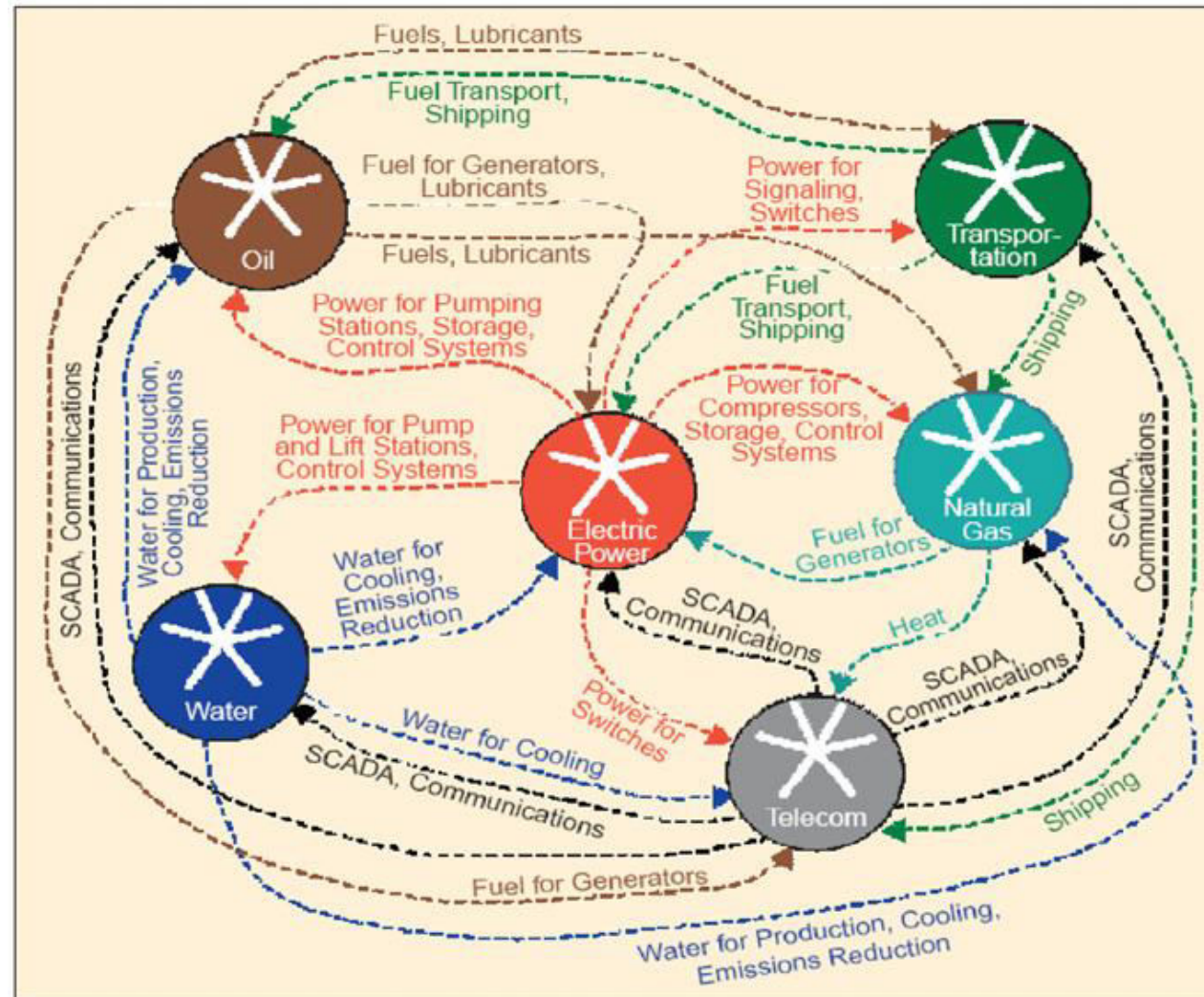
NOTE: "Hot Spot County" depict regions with statistically significant week-to-week high increase in infection rate

NOTE: Editions prior to 26 April 2020 included cases in Long-Term Care Facilities. These cases are removed from this analysis because their epidemiology has a dramatically different trajectory. Actual noted case decreases are artificial and best used as a new baseline. A comparison of rate change with and without LTC facilities is provided in the graph.

Source: MS Dept. of Health Map by DSU GIT Center gis.deltastate.edu



Interdependencies of Critical Infrastructures



"System-of-systems" approach for interdependent critical infrastructures, Irene Eusgeld, Nan Cen, Sven Dietz. Published in Reliab. Eng. Syst. Saf. 2011. Computer Science, Engineering

Monitoring COVID-19 Effects

- How will illness effect the food supply:
 - Use of space-based imaging to assess quantity of agronomic crops planted and their condition throughout the growing season
 - Monitor parking lot capacity at meat processing facilities (how much of the workforce is present?)
- How will illness effect transportation:
 - Number of parked aircraft, trucks, and trains compared to “normal”
- How will illness effect energy
 - Quantity of visible coal at power plants, assess refinery activities, etc...
- Big idea – integrate this information to tell an integrated story using standards and without bias.